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Milton Reservoir
Weld County, Colorado

National Eutrophication Survey, Corvallis, Oreg

Prepared for

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NATIONAL TECHNICAL
INFORMATION SERVICE

REPORT

ON

MILTON RESERVOIR

WELD COUNTY

COLORADO

EPA REGION VIII

Working Paper No. 774

With the cooperation of the

Colorado Department of Health

and the

Colorado National Guard

July, 1977

TECHNICAL REPORT DATA

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16. ABSTRACT

Annual total phosphorus and total nitrogen loadings to the lake were estimated and subdivided according to either point or non-point source origin. An assessment of the lake's trophic condition and limiting nutrient is also provided. All data collected by the U.S.E.P.A. National Eutrophication Survey during the one year study of the lake and its tributaries are included in the report.

17. KEY WORDS AND DOCUMENT ANALYSIS

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FOREWORD

The National Eutrophication Survey was initiated in 1972 in response to an Administration commitment to investigate the nationwide threat of accelerated eutrophication to freshwater lakes and reservoirs.

OBJECTIVES

The Survey was designed to develop, in conjunction with state environmental agencies, information on nutrient sources, concentrations, and impact on selected freshwater lakes as a basis for formulating comprehensive and coordinated national, regional, and state management practices relating to point-source discharge reduction and non-point source pollution abatement in lake watersheds.

ANALYTIC APPROACH

The mathematical and statistical procedures selected for the Survey's eutrophication analysis are based on related concepts that:

a. A generalized representation or model relating sources, concentrations, and impacts can be constructed.

b. By applying measurements of relevant parameters associated with lake degradation, the generalized model can be transformed into an operational representation of a lake, its drainage basin, and related nutrients.

c. With such a transformation, an assessment of the potential for eutrophication control can be made.

LAKE ANALYSIS

In this report, the first stage of evaluation of lake and watershed data collected from the study lake and its drainage basin is documented. The report is formatted to provide state environmental agencies with specific information for basin planning [§303(e)], water quality criteria/standards review [§303(c)], clean lakes [§314(a,b)], and water quality monitoring [§106 and §305(b)] activities mandated by the Federal Water Pollution Control Act Amendments of 1972.

Beyond the single lake analysis, broader based correlations between nutrient concentrations (and loading) and trophic condition are being made to advance the rationale and data base for refinement of nutrient water quality criteria for the Nation's fresh water lakes. Likewise, multivariate evaluations for the relationships between land use, nutrient export, and trophic condition, by lake class or use, are being developed to assist in the formulation of planning guidelines and policies by EPA and to augment plans implementation by the states.

ACKNOWLEDGEMENT

The staff of the National Eutrophication Survey (Office of Research & Development, U. S. Environmental Protection Agency) expresses sincere appreciation to the Colorado Department of Health for professional involvement, to the Colorado National Guard for conducting the tributary sampling phase of the Survey, and to those wastewater treatment plant operators who voluntarily provided effluent samples.

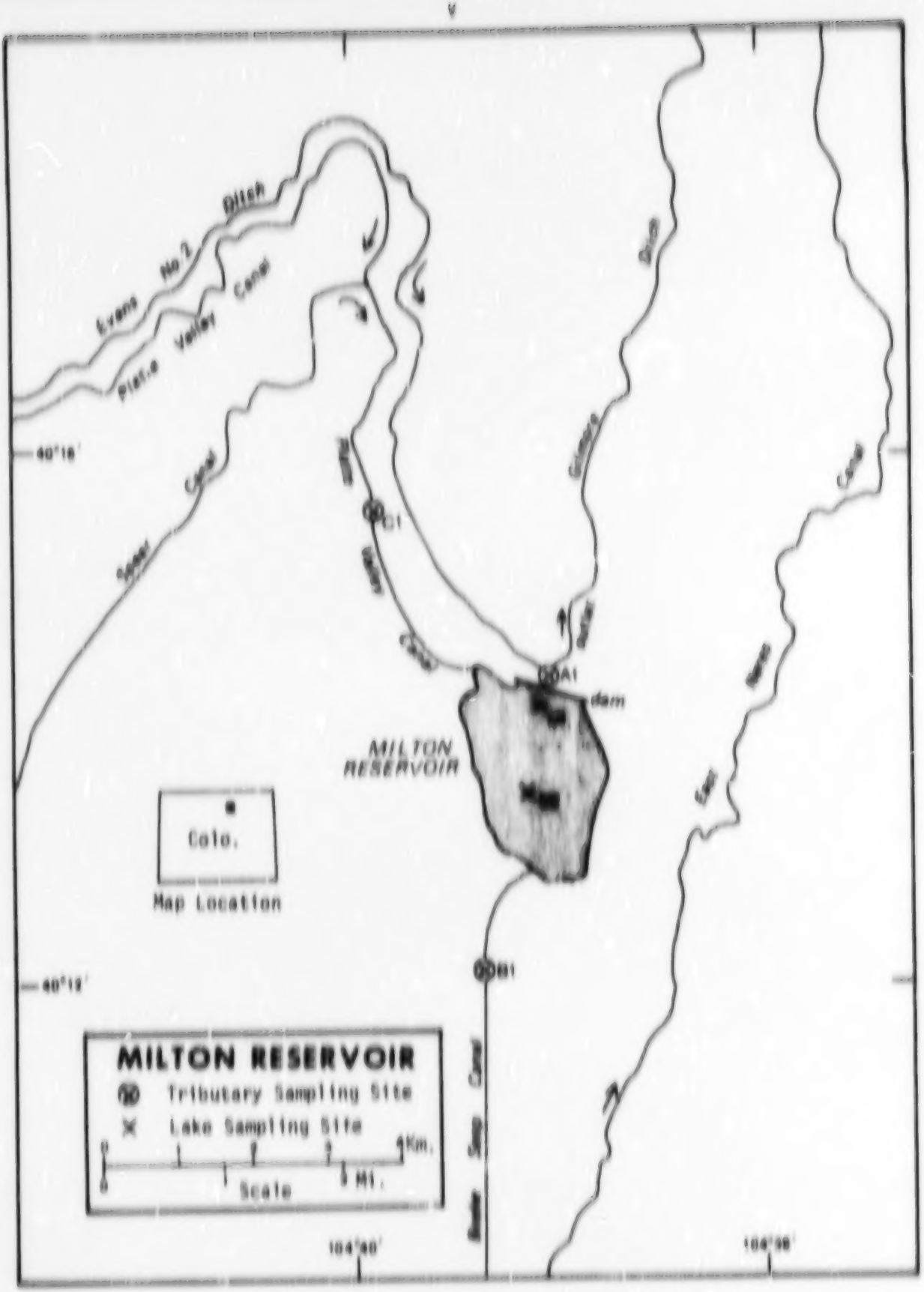
The staff of the Water Quality Control Division provided invaluable lake documentation and counsel during the Survey, reviewed the preliminary reports, and provided critiques most useful in the preparation of this Working Paper series.

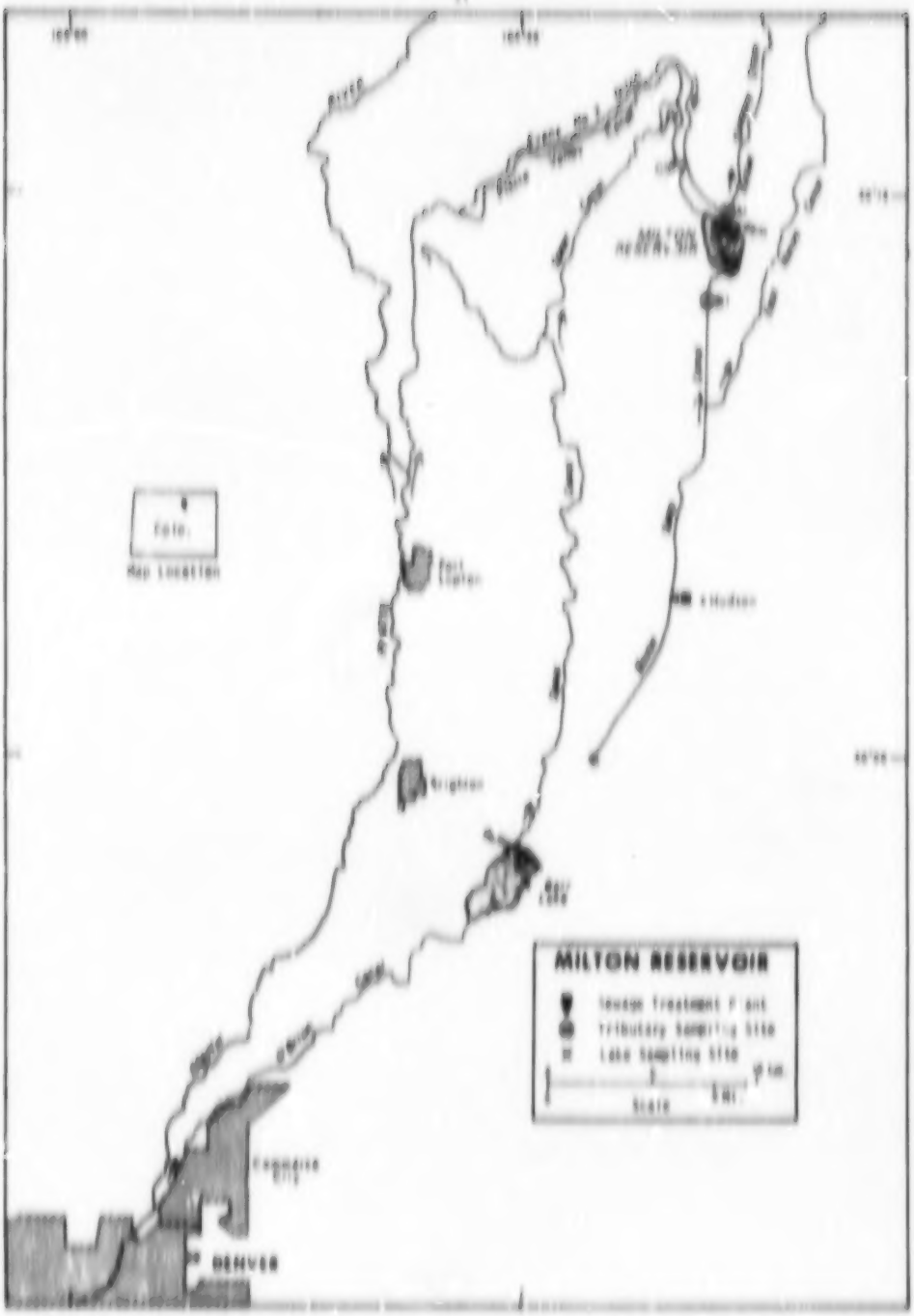
Lt. Colonel Paul A. Parsons, the Deputy Adjutant General of Colorado, and Project Officer Colonel Hershel C. Yeargan, who directed the volunteer efforts of the Colorado National Guardsmen, are also gratefully acknowledged for their assistance to the Survey.

NATIONAL EUTROPHICATION SURVEY
STUDY LAKES AND RESERVOIRS

STATE OF COLORADO

NAME	COUNTY
Barker	Boulder
Barr	Adams
Blue Mesa	Boulder
Cherry Creek	Arapahoe
Cucharas	Huerfano
Dillon	Summit
Grand	Grand
Green Mountain	Summit
Holbrook	Otero
Meredith	Crowley
Milton	Weld
Navajo	Archuleta, CO; San Juan, Rio Arriba, NM
Shadow Mountain	Grand


Ditch
Evans No 2
Platte Valley Canal
40°16'
Canal
Canal
Dam
Canal
Canal
Canal


Map Location
MILTON RESERVOIR
Denver

MILTON RESERVOIR
STORET NO. 0811

I. INTRODUCTION

Accurate flow data could not be provided for Milton Reservoir by the U.S. Geological Survey because water enters and leaves the lake through ungaged inlet and outlet canals. Therefore, this report primarily pertains to the lake sampling data. However, tributary and wastewater treatment plant samples were collected, and the results of the analyses are presented in Appendix D.

II. CONCLUSIONS

A. Trophic Condition:

Survey data indicate Milton Reservoir is eutrophic. It ranked tenth in overall trophic quality when the 13 Colorado lakes and reservoirs sampled in 1975 were compared using a combination of six parameters*. Eleven of the water bodies had less median total phosphorus, 12 had less median dissolved orthophosphorus and inorganic nitrogen, six had less mean chlorophyll a, and six had greater mean Secchi disc transparency.

B. Rate-Limiting Nutrient:

The algal assay results indicate the primary productivity of Milton Reservoir was nitrogen limited at the time the sample was collected (05/06/75). The reservoir data indicate nitrogen limitation at all sampling times.

* See Appendix A.

III. RESERVOIR AND DRAINAGE BASIN CHARACTERISTICS†

A. Morphometry††:

1. Surface area: 8.41 kilometers².
2. Mean depth: 7.3 meters.
3. Maximum depth: 12.5 meters.
4. Volume: 61.393 x 10^6 m^3.

B. Precipitation*:

1. Year of sampling: 34.6 centimeters.
2. Mean annual: 32.4 centimeters.

† Table of metric conversions--Appendix B.
†† Anderson, 1974.
* See Working Paper No. 175, "...Survey Methods, 1973-1976".

IV. WATER QUALITY SUMMARY

Milton Reservoir was sampled three times during the open-water season of 1975 by means of a pontoon-equipped Huey helicopter. Each time, samples for physical and chemical parameters were collected from one or more depths at two stations on the reservoir (see map, page v). During each visit, a single depth-integrated (4.6 m or near bottom to surface) sample was composited from the stations for phytoplankton identification and enumeration; and during the May visit, a single 18.9-liter depth-integrated sample was composited for algal assays. Also each time, a depth-integrated sample was collected from each of the stations for chlorophyll *a* analysis. The maximum depths sampled were 6.4 meters at station 1 and 3.4 meters at station 2.

The sampling results are presented in full in Appendix C and are summarized in the following table.

A SUMMARY OF PHYSICAL AND CHEMICAL CHARACTERISTICS FOR MILTON RESERVOIR
STORET CODE 0000

	1ST SAMPLING (5/ 6/75)			2ND SAMPLING (6/25/75)			3RD SAMPLING (10/20/75)		
	2 SITES			2 SITES			2 SITES		
PARAMETER	RANGE	MEAN	MEDIAN	RANGE	MEAN	MEDIAN	RANGE	MEAN	MEDIAN
TEMP (C)	12.- - 13.3	12.-	13.0	21.0 - 23.2	22.5	22.6	13.0 - 13.-	13.3	13.2
DISS OXY (MG/L)	5.- - 6.-	6.-	6.-	6.- - 7.2	6.9	7.0	5.0 - 6.-	6.0	6.0
CONDTVY (MICROMHOS)	112.- - 194.-	153.-	153.-	124.- - 133.-	129.-	130.-	109.- - 109.-	109.-	109.-
PH (STAND UNITS)	6.2 - 6.-	6.1	6.2	9.0 - 9.0	9.0	9.0	6.1 - 6.2	6.2	6.2
TOC (MG/L)	27.- - 28.-	28.-	28.-	33.- - 37.-	35.-	36.-	32.- - 40.-	36.-	36.-
TOT P (MG/L)	1.154 - 1.178	1.16-	1.16-	0.738 - 0.73-	0.73	0.73-	0.748 - 0.879	0.813	0.84-
INTAG P (MG/L)	1.107 - 1.140	1.12-	1.12-	0.588 - 0.60-	0.59	0.62-	0.669 - 0.68-	0.75-	0.74-
ORTHO P (MG/L)	1.03- - 0.07-	1.07	1.07-	0.62- - 0.62-	0.62	0.62-	0.66- - 1.08-	1.07	1.07-
AMMONIA (MG/L)	1.42- - 1.77-	1.59-	1.57-	0.11- - 0.24-	0.18	0.18-	1.78- - 1.82-	1.80	1.80-
KJEL N (MG/L)	2.78- - 2.80-	2.79-	2.79-	1.29- - 1.30-	1.29	1.30-	2.79- - 3.38-	3.07	3.08-
INTRA N (MG/L)	2.26- - 2.29-	2.28-	2.27-	1.13- - 1.16-	1.15	1.22-	2.75- - 2.79-	2.77	2.76-
TOTAL N (MG/L)	3.47- - 3.62-	3.53-	3.53-	1.22- - 1.32-	1.28	1.32-	3.49- - 5.12-	4.02	4.79-
CHLRPHYL A (UG/L)	1.- - 1.-	1.-	1.-	0.- - 19.-	12.-	12.-	4.- - 4.-	4.-	4.-
SECCHI (METERS)	1.- - 1.-	1.-	1.-	1.- - 1.-	1.-	1.-	0.- - 0.-	0.-	1.-

B. Biological Characteristics:

1. Phytoplankton -

Sampling Date	Dominant Genera	Algal Units per ml
09/09/75	1. Pediastrum sp.	102
	2. Cryptomonas sp.	102
	3. Chrysomonas (?) sp.	102
	4. Schroederia sp.	61
	5. Scenedesmus sp.	61
	Total	408
08/26/75	1. Melosira sp.	590
	2. Fragillaria sp.	553
	3. Chrysomonas (?) sp.	406
	4. Asterionella sp.	369
	5. Anabaena sp.	332
	Other genera	257
	Total	2,507
10/10/75	1. Chrysomonas (?) sp.	272
	2. Nitzschia sp.	136
	3. Cyclotella sp.	91
	4. Pennate diatoms	91
	5. Aphanizomenon sp.	45
	Other genera	89
	Total	724

2. Chlorophyll a -

Sampling Date	Station Number	Chlorophyll a (ug/l)
09/09/75	1	1.3
	2	1.4
08/26/75	1	8.3
	2	16.0
10/10/75	1	4.1
	2	4.3

C. Limiting Nutrient Study:

1. Autoclaved, filtered, and nutrient spiked -

Spike (mg/l)	Ortho P Conc. (mg/l)	Inorganic N Conc. (mg/l)	Maximum yield (mg/l-dry wt.)
Control	1.040	1.035	7.2
0.050 P	1.090	1.035	7.2
0.050 P + 1.0 N	1.090	2.035	24.5
1.0 N	1.040	2.035	16.7

2. Discussion -

The control yield of the assay alga, Selenastrum capricornutum, indicates that the potential primary productivity of Milton Reservoir was high at the time the assay sample was collected (05/06/75). Also, the addition of nitrogen alone and in combination with phosphorus resulted in a significant increase in yield which indicates the reservoir was nitrogen limited at that time. Note that the addition of phosphorus alone resulted in a yield not significantly greater than that of the control.

The reservoir data substantiate nitrogen limitation. The mean inorganic nitrogen to orthophosphorus ratios were 4 to 1 or less at all sampling times.

V. NUTRIENT SOURCES
(See Appendix D for data)

The operator of the Hudson Sanitation Company wastewater treatment plant provided monthly effluent samples and estimated flow data. The results of the analyses of the samples are included in Appendix D.

A. Known municipal*:

Name	Pop. Served	Treatment	Mean Flow (m³/d)	Receiving Water
Hudson Sanitation Co.	600	stab. pond	189.3	Beebe Seep Canal

B. Known industrial - None

C. Mean Nutrient Concentrations in Ungaged Streams:

Tributary	Mean Total P Conc. (mg/l)	Mean Total N Conc. (mg/l)
Gilmore Ditch	0.980	3.206
Beebe Canal	0.501	3.730
Platte Valley Canal	1.367	6.067

* Treatment plant questionnaire.

VI. LITERATURE REVIEWED

Anderson, R. Dennis, 1974. Personal communication (waterbody information and morphometry). CO Dept. of Health, Denver.

VII. APPENDICES

APPENDIX A

LAKE RANKINGS

[illegible]

LAKE CODE	LAKE NAME	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
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[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

LAKES RANKED BY [illegible]

Rank	LAKE CODE	LAKE NAME	[illegible]
1	[illegible]	[illegible]	521
2	[illegible]	[illegible]	475
3	[illegible]	[illegible]	451
4	[illegible]	[illegible]	433
5	[illegible]	[illegible]	368
6	[illegible]	[illegible]	364
7	[illegible]	[illegible]	296
8	[illegible]	[illegible]	295
9	[illegible]	[illegible]	283
10	[illegible]	[illegible]	283
11	[illegible]	[illegible]	257
12	[illegible]	[illegible]	254
13	[illegible]	[illegible]	95

APPENDIX B

CONVERSION FACTORS

CONVERSION FACTORS

Hectares x 2.471 = acres

Kilometers x 0.6214 = miles

Meters x 3.281 = feet

Cubic meters x 8.107 x 10^{-4} = acre/feet

Square kilometers x 0.3861 = square miles

Cubic meters/sec x 35.315 = cubic feet/sec

Centimeters x 0.3937 = inches

Kilograms x 2.205 = pounds

Kilograms/square kilometer x 5.711 = lbs/square mile

APPENDIX C

PHYSICAL and CHEMICAL DATA

APPENDIX D

TRIBUTARY AND WASTEWATER TREATMENT PLANT DATA

[illegible]